Supportive User Interfaces in Adaptation

Víctor López-Jaquero
Laboratory on User Interaction & Software Engineering (LoUISE)
University of Castilla-La Mancha
02071 Albacete, Spain
+34 967 59 92 00
victor@dsi.uclm.es

Francisco Montero
Laboratory on User Interaction & Software Engineering (LoUISE)
University of Castilla-La Mancha
02071 Albacete, Spain
+34 967 59 92 00
fmontero@dsi.uclm.es

ABSTRACT
In this paper a discussion of how supportive user interfaces can be used in user interfaces with adaptation capabilities is provided. This discussion in made using as reference ISATINE adaptation framework, where the stages for a proper adaptation process and the tasks the user can get involved during the adaptation process are clearly described. Moreover, some open questions are enunciated to help in the identification of open issues in supportive user interfaces field.

Keywords
Supportive user interfaces, adaptation, ISATINE adaptation framework

INTRODUCTION
The growing complexity of the applications being currently developed to match complex functionality requirements, and the myriad of situations where the users want to interact with those applications has provoked the creation of complex user interfaces. Nevertheless, the complexity of the user interfaces produced together with the great number of features available in the user interface can easily lead to the misuse or underuse of the applications, by-passing important features that could increase user performance.

Furthermore, another issue found in complex applications covering a wide range of requirements is that each group of users takes advantage of a small part of the functionalities, but all the extra unused features still remain in the user interface, occupying screen space and conveying extra cognitive load to the user that is not required to perform the tasks.

These issues go beyond regular desktop applications, and get even worse for those applications designed for mobile devices, since the space available to present the user interface is greatly reduced. Thus, the functionalities found more common during the design process are usually the fastest to be carried out though the user interfaces. But, what if other users encounter problems finding some other functionality considered to be unimportant during the design? Should not the application support rearranging the user interface to support these unforeseen needs?

So far, the problems identified concern the complexity of the user interface and the heterogeneity of contexts of use. Nevertheless, another issue comes to play: understanding the user interface (one of the factors usability is considered to be composed of). Even for user interfaces with a reduced set of functionalities, the user can find it hard to understand how to carry out a task because the designers failed to match user's mental model.

In all these situations, supportive user interfaces (SUIs) [4] can prove useful. We find that this kind of user interfaces are also closely related to adaptation, as considered in ISATINE framework [2], because SUIs are required to help in performing several stages of the adaptation process proposed in this framework.

SUPPORTIVE USER INTERFACES IN ADAPTATION
Adaptation can range from adaptability, where the user is in charge of performing the adaptation process, to adaptivity, where is the system the entity in charge of performing the adaptation process. Nevertheless, many intermediate configurations are possible, where different entities are responsible for the several stages required to carry out user interface adaptation.

Next, ISATINE framework is briefly discussed to illustrate how adaptation, either adaptability or adaptivity, or any other combination to reach adaptation, should be enriched with SUIs throughout the adaptation process stages.

ISATINE adaptation framework
ISATINE framework [2] is a specialization of Norman's theory of action for adaptation, aiming at covering the whole adaptation cycle, going beyond most adaptation frameworks, mostly focused on the actual execution of the adaptation. Three entities are considered in this framework: the user (U), the interactive system (S), or any third party (T). Find below a brief explanation of the stages found in this adaptation process:

- Goals for user interface adaptation: any entity (U, S, or T) may be responsible for establishing and maintaining up-to-date a series of goals to ensure user interface adaptation.

- Initiative for adaptation: this stage is further refined into formulation for an adaptation request, detection of an adaptation need, and notification for an adaptation request, depending on their location.
- Specification of adaptation: this stage is further refined in specification by demonstration, by computation, or by definition, depending on their origin: respectively, U, S, or T.
- Application of adaptation: this stage specifies which entity will apply the adaptation specified in the previous stage. Since this adaptation is always applied on the UI, this UI should always provide some mechanism to support it.
- Transition with adaptation: this stage specifies which entity will ensure a smooth transition between the UI before and after adaptation. For instance, if S is responsible for this stage, it could provide some visualization techniques, which will visualize the steps, executed for the transition.
- INterpretation of adaptation: this stage specifies which entity will produce meaningful information in order to facilitate the understanding of the adaptation by other entities. Typically, when S performs some adaptation without explanation, U does not necessarily understand why this type of adaptation has been performed.
- Evaluation of adaptation: this stage specifies the entity responsible for evaluating the quality of the adaptation performed so that it will be possible to check whether or not the goals initially specified are met.

SUI in ISATINE

Supportive user interfaces could be thought for almost every stage in ISATINE framework. In this section some examples are provided to show how they could be used to help in the adaptation process in several stages. Some specific examples of SUI supporting ISATINE framework can be found in [3].

Specification of adaptation

In this stage there are two tasks in which the user could be supported. The first one is specifying the adaptation that the user would like to apply. This is already very common for adaptable or customizable user interfaces, where the user is supported in specifying what to change. It is also a common task in end-user programming for user interface adaptation. In this kind of task the user should be presented with a user interface to support the specification of the adaptations. Notice how this supportive user interface could be either part of the regular user interface or not.

The second task in this stage where the user can be supported is the selection of what adaptation to apply among a set of plausible adaptations. A user interface should be provided by the system to do this task. Very simple SUIs could be used to support the user, i.e. a simple selection list. However, much more complex SUIs could be imagined, i.e. providing previews for each adaptation selectable.

Application of adaptation

In this stage the adaptation selected should be applied to the user interface. If is the user the entity in charge, then a user interface must be provided to carry out this task. For instance, if the adaptation to be applied is for changing user interface elements layout, the user could be supported by providing a user interface where the user can move around the user interface.

Evaluation of adaptation

In this stage the system should assess how good an adaptation has been. If it is the user the entity in charge of performing this stage, then a user interface should be presented for the user to express his opinion. For instance, in [1] they present to the user a simple UI with different *smilies*, which represent how happy the user feels about the last adaptation.

Next, a discussion of SUIs in adaptation is included.

DISCUSSION AND OPEN QUESTIONS

The first thing to clarify is what we mean with supportive user interface. For us a SUI is a UI that exploits UI meta-model information to convey/receive information about the UI to/from the user, or provides a means to modify the structure, behavior or contents of the UI. Regarding the definition of SUI one question arises: are SUI a complement or an evolution of Mega-UI [5]?

SUI can be either part of the regular UI or not. Nevertheless, they should not escape general UI design principles and guidelines, although some extra ones should appear because of their supportive nature. We have plenty of design guidelines, interaction patterns, heuristics, design principles and standards, but how can be integrate all this plethora of knowledge in the design process, and more concretely in the design in the design process of SUI.

The design of SUIs for adaptation should pursue especially consistency, for the user to gain a common mental model for user interface adaptation tasks, as the user already has for the general task in a user interface.

Another open question is what the relation is between SUI and Intelligent User Interfaces (IUI). Therefore, we have to consider supportive vs. intelligent user interfaces. Will the *S* in SUI finally become “Semantic” to achieve Semantic User Interfaces. Has the evolution in the Web gone further beyond to reach the desktop to foster cooperative, semantic and ubiquitous desktop user interfaces?

SUIs require also the user of proper metaphors to prevent the user from becoming puzzled because of the usual overwhelming complexity of the underlying UI meta-model that SUI should manage.

Yet another open question is the evaluation of this kind of user interfaces. What criteria and metrics should be considered during the evaluation of SUIs? Is usability enough?

Still much understanding and general principles for SUI design are to be discovered. Adaptation capabilities are clearly a good domain to test this understanding and principles for SUI design, since as discussed in ISATINE framework, it requires of SUI for many of the adaptation stages to carry out a proper adaptation process.

To sum up, should we go one step further, and even coin the term Supportive User Interfaces Engineering (SUIE)? What is the relation SUIE has with Usability Engineering, Model-Based Development of User Interfaces or Model-Driven Development?

In this sense, we do believe ISATINE framework can provide a guide for the consideration of the specification, design, deployment and evaluation of SUIs.

ISATINE framework can help in providing SUI designers with a guide of what aspects should address the designer to create a SUI that: (i) effectively manipulates the user interface (therefore the specification of what is manipulated in the user interface should be carried out: Specification state in ISATINE), (ii) actually makes the required changes to the user interface (Execution stage in ISATINE), (iii) makes sure that the transition to the new version of the user interface produced by the SUI from the original one is smooth enough so the user does not get confused (Transition stage in ISATINE) or (iv) explains the user what changes were made (INterpretation stage in ISATINE). In our opinion, SUI designers could benefit from ISATINE guidelines for adaptation, but it should be probably refined to reflect the peculiarities of SUI.

ACKNOWLEDGMENTS

This work has been partially supported by grant PEII09-0054-9581 from the Junta de Comunidades de Castilla-La Mancha and also by the grant TIN2008-06596-C02-01 from the Spanish Government.

REFERENCES

1. Arhippainen, L., Rantakokko, T. and Tähti, M.: 2005, Navigation with an Adaptive Mobile Map-Application: User Experiences of Gesture- and Context-Sensitiveness. In: Proceedings of 2nd International Symposium on Ubiquitous Computing Systems, UCS'2005, Tokyo, November 8-9, 2004. Vol. 3598 of Lecture Notes in Computer Science. pp. 62–73, Springer, Berlin.
2. López Jaquero, V., Vanderdonckt, J., Montero, F., González, P. Towards an Extended Model of User Interface Adaptation: the ISATINE framework, Proc. of Engineering Interactive Systems 2007, EIS'2007 (Salamanca, 22-24 March 2007), M.B. Harning, J. Gulliksen (eds.), Springer-Verlag, Berlin, 2007. ISSN: 0302-9743
3. López-Jaquero, V., Montero, F. and Gonzalez, P. AB-HCI: an interface multi-agent system to support human-centred computing , IET Softw. 3, 14 (2009), DOI:10.1049/iet-sen:20070108.
4. Demeure, A., Lehmann, G., Petit, M. Calvary, G. Supportive User Interface description. http://www.supportiveui.org/cfp.html
5. Sottet, J-S., Calvary, G., Favre, J-M. and Coutaz, J. Megamodeling and Metamodel-Driven Engineering for Plastic User Interfaces: MEGA-UI. In Human-Centered Software Engineering, pp 173-200, Seffah, A., Vanderdonckt, J. and Desmarais, M. C. (eds.), Springer Human-Computer Interaction Series. 2009.